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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/083,756	02/25/2002	Do-Hyung Kim	4591-227	2262

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EXAMINER

HU, SHOUXIANG

ART UNIT	PAPER NUMBER
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2811

MAIL DATE	DELIVERY MODE
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07/26/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/083,756

Applicant(s)

KIM ET AL.

Examiner

Shouxiang Hu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 May 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15, 17, 18, 20-22 and 24-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15, 17, 18, 20-22 and 24-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-10 and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura (US 2002/0121661) in view of Suzuki (6,228,166) and/or Maeda (US 6,231,673) and/or Gilmer (US 5,904,542).

Nakamura discloses a method for forming a composite oxide layer, including a thermal oxide layer (9a) and a CVD oxide layer (10a), having a first thickness as the combined thickness in an integrated circuit device, the method (Fig. 4; also see Paragraph [0085]) naturally comprising: growing the thermal oxide layer (9a) having a second thickness thinner than the first thickness on a surface of a semiconductor substrate; and, after growing the thermal oxide layer (9a) and directly on it, forming the CVD oxide layer (10a) naturally in a chemical vapor deposition (CVD) apparatus, the CVD oxide layer having a third thickness naturally substantially equal to a difference between the first thickness and the second thickness.

Although Nakamura does not expressly disclose that the thermal oxide can also be formed inside the same CVD apparatus, one of ordinary skill in the art would readily recognize that such thermal oxide layer can be desirably formed in the same CVD

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apparatus, so as to simplify the process and/or reduce the process cost and/or time, as readily evidenced in Suzuki (col. 10, lines 13-27), and/or Maeda (col. 15, lines 50-55), and/or Gilmer (col. 4, lines 1-10).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to develop the method of Nakamura with the thermal oxide layer being formed in the same CVD apparatus, per the teachings of Suzuki and/or Maeda and/or Gilmer, so that a method for making a composite oxide layer with simplified process and/or with reduced process cost and/or time would be obtained.

Regarding claims 2, 6, 7, 8, 10-13, it is noted that the thicknesses of the thermal oxide layer and the CVD oxide layer, the temperatures for the thermal oxidation and the CVD, and/or, the substrate-consumed thickness associated with the thermal oxide layer, are all art-recognized important result-oriented parameters subject to routine experimentation and optimization; and, that each of the thicknesses and temperatures are respectively well within the corresponding parameter ranges commonly recognized in the art. Thus, it would be well within the ordinary skill in the art to develop the method collectively taught above with the corresponding thicknesses and temperatures being respectively about the ones as recited in the claims, so as to form the oxide layer with optimized performance and/or process, since it has been held that "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Regarding claim 4, it is noted that it is well known in the art that the gate layer (11) in Nakamura, which is readable as an "another material layer", can be commonly formed of polysilicon through CVD inside a CVD apparatus, as readily evidenced in the prior art such as Schwabe (US 4,510,670; col. 3, lines 50-53). Accordingly, it would be well within the ordinary skill in the art to further form the gate layer with polysilicon in the same CVD apparatus in the method collectively taught above, so that the gate therein would be formed with a simplified process.

Regarding claims 5, 9, 10 and 14, it is noted that it is well known that O₂ and/or N₂O are commonly used in the art to form a thermal oxide layer; and that the N₂O and/or SiH₄ are commonly used in the art to form a CVD oxide layer.

Regarding claim 8, it is further noted that the method of Nakamura further comprises a step of forming a trench into the substrate.

3. Claims 11, 15, 17-18, 20-22 and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agahi (US 6,140,208) in view of Nakamura (US 2002/0121661) and/or Nakanishi (US 6,103,557), and further in view of Suzuki (6,228,166) and/or Maeda (US 6,231,673) and/or Gilmer (US 5,904,542).

Agahi discloses a method of forming a layer for an integrated circuit device (Figs. 5 and 6), comprising: forming a trench in substrate (that is commonly a single crystalline silicon) by etching; forming a composite oxide layer of a double layer structure (23 and 20) having a first thickness as its total thickness on a surface of the trench; forming a nitride liner layer (43) on the composite oxide layer, and forming an oxide trench isolation material layer (47), wherein forming the composite oxide layer comprises:

forming a thermal oxide layer having a second thickness (such as 50-100 Å) on the trench; forming a conformal liner material layer having a third thickness (such as 50-300Å) that is naturally substantially equal to a difference between the first thickness and the second thickness; and, wherein the substrate can naturally be consumed by a thickness within the recited thickness range of 8.8 Å to 44 Å, during the formation of the thermal oxide layer, since the thermal oxide layer can have a thickness of about 50-100 Å.

Although Agahi does not expressly disclose that the thermal oxide, the conformal oxide liner and the nitride layer can all be formed inside a same CVD apparatus, one of ordinary skill in the art would readily recognize that an oxide liner can be desirably formed with CVD method so as to achieve the desired liner conformity, as evidenced in Nakamura (see the CVD oxide layer 10a in Fig. 4); that an oxide layer and a nitride layer can both be formed through CVD in a same CVD apparatus so as to simplify the process, as evidenced in Nakanishi (col. 5, lines 60-67); and, that the thermal oxidation process and the CVD process can be desirably carried out inside a same CVD apparatus, so as to simplify the process and/or reduce the process cost and/or time, as readily evidenced in Suzuki (col. 10, lines 13-27) and/or Maeda (col. 15, lines 50-55) and/or Gilmer (col. 4, lines 1-10).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to develop the method of Agahi with the thermal oxide layer, the conformal oxide liner layer and the nitride liner layer being formed in the same CVD apparatus, per the teachings of Nakamura and/or Nakanishi, and/or the teachings

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of Suzuki and/or Maeda and/or Gilmer, so that a method for making trench structure having liner layers therein with simplified process and/or with reduced process cost and/or time would be obtained.

Regarding claims 20 and 25, it is noted that the temperatures for the thermal oxidation and the CVD are both art-recognized important result-oriented parameters subject to routine experimentation and optimization; and, that each of the temperatures are respectively well within the corresponding parameter ranges commonly recognized in the art. Thus, it would be well within the ordinary skill in the art to develop the method collectively taught above with the corresponding temperatures being respectively about the ones as recited in the claims, so as to form the oxide layer with optimized performance and/or process, since it has been held that "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Regarding claims 20 and 25, it is further noted that it is well-known that O₂ and/or N₂O are commonly used in the art to form a thermal oxide layer; and the N₂O and/or SiH₄ are commonly used in the art to form a CVD oxide layer.

Regarding claims 21-22 and 24-26, it is noted that it is well known in the art that the trench isolation material layer can be commonly formed through CVD. And, it would be well within the ordinary skill in the art to further form the trench isolation material layer in the same CVD apparatus in the method collectively taught above, so as to further simplify the process and/or further reduce the process cost and/or time.

Response to Arguments

4. Applicant's arguments filed on May 08, 2007 have been fully considered but they are not persuasive, as further below.

Applicant's main arguments include that the applied prior art references do not teach the claimed invention. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In this case, at least Nakamura expressly teaches that an upper oxide layer in a composite oxide layer can be readily formed through a CVD method that is naturally carried out inside a CVD apparatus. And, each of Suzuki (col. 10, lines 13-27), Maeda (col. 15, lines 50-55) and Gilmer (col. 4, lines 1-10) expressly teaches to form a thermal oxide layer inside a same apparatus used for forming CVD layer(s). Accordingly, the combined teachings of Nakamura (or that of Agahi in view of Nakamura) with Suzuki, Maeda and/or Gilmer do result in the method of the claimed invention, including forming the recited thermal oxide layer and the recited CVD oxide layer both inside a CVD apparatus.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in

the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Suzuki, Maeda and/or Gilmer each expressly reaches that a thermal oxide layer can be readily formed inside a CVD apparatus. Therefore, it would well within the ordinary skill in the art to develop a method involving a composite oxide layer having a CVD oxide layer overlying a thermal oxide layer, such as that of Nakamura or that of Agahi in view of Nakamura, with the thermal oxide layer being formed in the same CVD apparatus used for forming the CVD oxide layer therein, per the teachings of Suzuki and/or Maeda and/or Gilmer, so as to have a method for making a composite oxide layer with simplified process and/or with reduced process cost and/or time. It is because the ordinary skill in the art would readily recognize that, comparing with a method of forming the composite oxide layer through separated thermal oxidation apparatus and CVD apparatus, the method of forming the composite oxide layer inside a single apparatus would obviously and/or readily simplify the process steps and/or reduce process cost and/or time, since it can at least obviate the step of transferring the substrate between the two apparatus, and at least save the cost by avoiding any spending on the separated thermal oxidation apparatus along with the would-be-required relevant substrate-transferring apparatus.

With respect to arguments regarding claims 11, 15, 17-18, 20-22 and 24-26, it is further noted that: it is art known that an oxide liner deposited with high conformity (i.e., step coverage) is commonly desirable for achieving high quality of electrical insulation/isolation. And, it is also art known that a layer formed through CVD method, such as the one in Nakamura (the CVD oxide layer 10a in Fig. 4) is generally superior in

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conformity and/or quality than a same-material layer formed through sputtering, which can be readily evidenced in the prior art such as Chen et al. (US 6,303,501; see col. 1, lines 27-36).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to develop the method of Agahi with the thermal oxide layer, the conformal oxide liner layer and the nitride liner layer being formed in a same CVD apparatus, per the teachings of Nakamura and/or Nakanishi, and/or the teachings of Suzuki and/or Maeda and/or Gilmer, as it would obviously provide a desired method for making a trench structure, in which the required oxide liner can have the desired superior conformity while all the liner layers can be formed inside a same apparatus so as to simplify the process and/or to reduce the process cost and/or time.

In addition, regarding applicant's relevant arguments about the CVD temperatures, it is noted that the temperatures for CVD depositions are art-recognized important result-oriented parameters subject to routine experimentation and optimization. Thus, it would be well within the ordinary skill in the art to develop the method collectively taught above with the CVD temperatures being within the ones of the instant invention, so as to form the liners with optimized performance and/or process, since it has been held that "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference A is cited as being related to the comparison between CVD method and sputtering method.

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-1654. The examiner can normally be reached on Monday through Friday, 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynne Gurley can be reached on 571-272-1670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SH
July 16, 2007



SHOUXIANG HU
PRIMARY EXAMINER